

Port-Led Development and Economic Returns: Comparative Empirical Assessments of the Great Nicobar Island Project

Abstract

In recent years, the Indian national government has aimed to place a Rs 44,000 crore transshipment port at Galathea Bay. This paper looks to investigate, examine, and simulate comparable ports that can shed light on this upcoming project's long-term benefits, costs and risks. It constructs a verified panel of 94 annual turnover records for six similar hubs from 1999 to 2025, estimates seven unique regression models, and ultimately performs a test using a cost-benefit model summing 20,000 Monte Carlo simulations. Hub traffic mainly comes to look closer at world trade, with elastic values about 1.5, rather than the host economy. As a result, success has depended on securing a major shipping line before opening. In reality, the port returns a positive economic value to India in only 5.5% of simulations. Without traffic near 16 million TEU, an early carrier commitment and staged construction, its strategic benefits would need to be worth Rs 740 to 1,780 crore a year to even justify its continuation on the Andaman-Nicobar Islands.

Keywords: transshipment, Monte Carlo simulation, Great Nicobar, Shompen

Introduction

Great Nicobar is India's southernmost island. It is located approximately 40 nautical miles from the East-West shipping lane through the Malacca Strait. Through efforts of surveying and prospecting, the Indian government plans a four-phase transshipment port at Galathea Bay reaching 16 million twenty-foot equivalent units (TEU) by 2058, at an estimated Rs 44,313 crore (Indian Infrastructure, 2025). A lengthier programme adds an airport, power plant and township and requires diverting about 130 square kilometres of forest (India Seatrade News, 2026a). In February 2026 the National Green Tribunal (NGT) upheld its environmental clearance (Kotak Neo, 2026).

About 75% of India's transhipped containers are being organized and supplied at foreign hubs. As a result, this has cost Indian ports an estimated US\$200 to 220 million a year (Maritime Gateway, nd.). This paper asks the question of to what extent can the economic outcomes of comparable port projects inform estimates of the long-term benefits, costs and risks of the Great Nicobar port? Observed outcomes are kept separate from modelled projections throughout.

Literature Review

Port efficiency has a strong effect on transport costs and trade regulation (Limão & Venables, 2001; Clark et al., 2004). The core notion is that ports can benefit from urban growth (Fujita & Mori, 1996) but the observed local effects are ultimately modest (Bottasso et al., 2013) and benefits are often transferred to various, distinct regions while costs are borne locally. Thus, the processes of transshipment are concentrated in single carrier alliances created to move millions of containers (Notteboom & Rodrigue, 2005). Megaprojects systematically overrun costs (Flyvbjerg et al., 2002), and staging permanent investments under uncertainty has an opportunity cost.

Historical Background

The first description of the islands appears under the title *Nakkavaram* in 1050 CE Tamilian scriptures. Later, Danish colonists held this land from 1756. However, malaria would force repeated abandonment by the Danish. Its rights were sold to Britain in 1868 (Wikipedia contributors, 2026a), an early precedent of underestimating the cost of remoteness. The Shompen, hunter-gatherers of the interior, numbered only 229. As of the 2011 census, they have been branded as a Particularly Vulnerable Tribal Group by the Indian national government. The 2004 tsunami accounted for up to 4.25 metres of downward settlement, steering away the Galathea leatherback nesting beach (Current Conservation, 2009) and scattering the coastal Nicobarese. After the calamity, its leaders have surmised that a hopeful return may never see light (Mongabay India, 2026). Thankfully, the beach restored itself naturally through the testament of time.

Table 1. Key events in the history of Great Nicobar and the port project

Year	Event	Economic significance
1050 CE	Islands recorded as Nakkavaram in a Chola inscription	Long-standing position on Indian Ocean trade routes
1756 to 1868	Danish colony of Frederiksoerne, repeatedly abandoned because of malaria	Early evidence of the cost of remoteness
1846	Danish corvette Galathea makes first recorded contact with the Shompen	Origin of the port site's name
1869	Islands incorporated into British India	Beginning of administration from the mainland
1942 to 1945	Japanese occupation	First demonstration of the islands' strategic value
1956	Andaman and Nicobar Islands formed as an Indian union territory	Central government control of land use
1997	Galathea Bay named a wildlife sanctuary for leatherback turtles	Legal protection of the future port site
2004	Tsunami; land subsides up to 4.25 m; Nicobarese villages relocated	Disaster risk; displaced communities
2013	UNESCO lists the Great Nicobar Biosphere Reserve (103,870 ha)	International conservation status
2021	Galathea Bay sanctuary denotified	Legal path cleared for construction
2022	Environmental and forest clearances; tribal council grants and consented withdrawal acceptance	Social cost and legal risk

2024	Galathea Bay becomes India's 14th "Major Port"	Central government ownership of core port
2026	Tribal leaders publicly oppose the project (January) whilst NGT nevertheless upholds its clearance (February)	Project advances toward tender

Note. Sourced from Wikipedia contributors (2026a, 2026b), Drishti IAS (2026), Mongabay India (2026)



Figure 1. Father and son of Shompen tribe

Comparator Port Analysis

Six transshipment hubs on the same East-West route were chosen to span the full range of outcomes.

Table 2. Founding histories and outcomes of the comparator ports

Port	Founding history	Subsequent outcome	2025 TEU (millions)
Tanjung Pelepas, Malaysia	Founded in 2000. Moved the regional hub there from Singapore.	2 million TEU by second year. Record 14.03 million in 2025 (New Straits Times, 2026)	14.03
Salalah, Oman	Developed 1996 to 1998 by the Omani government with Maersk Line and Sea-Land (Salalah Port Services, n.d.)	Consistent increase to about 4 million TEU, then a plateau	4.30
Piraeus, Greece	COSCO took over both Piers II and III in 2009. Successfully collects 51% of the port authority in 2016 (Seatrade Maritime, 2021)	Accumulate a sixfold portion in a decade, to 5.65 million TEU in 2019 (Seatrade Maritime, 2020)	4.80
Colombo, Sri Lanka	Mature natural harbour. Handling about 45% of India's foreign-transhipped cargo (Swarajya)	Passed 4, 5, 6 and 7 million TEU in 2010, 2015, 2017 and 2018 (Sunday Times, 2019)	8.29
Hambantota, Sri Lanka	Started 2010's with US\$1.26 billion of mostly Chinese loans. (Maritime Executive, n.d.)	34 ship called in 2012; leased for 99 years for US\$1.12 billion in 2017; containers only from 2023	0.43
Vizhinjam, India	Opened December 2024; MSC underwrites its volumes (India Seatrade News, 2026b)	1.30 million TEU in first full year	1.30

Hambantota is by far the closest comparison to a remote, state-led port justified partly on strategic grounds that was built before any carrier committed. In 94 turnover records, drawn from structural releases, annual reports and statistical tables, then vetted against milestone and cumulative announcements; 32 (34%) were verified, 10 (11%) cross-checked and 52 (55%) awaited verification. To account for errors where sources conflicted, it was imperative to use current figures (for example, the detailed project report cost of Rs 44,313 crore) and the remaining uncertainty was tested in the model.

Table 3. Descriptive statistics of the throughput panel

Port	Years covered	Records	First-year TEU (M)	2025 TEU (M)	Peak TEU (M)	Compound annual growth
Tanjung Pelepas	2000 to 2025	26	0.42	14.03	14.03	15.1%
Piraeus	2010 to 2025	16	0.86	4.80	5.65	12.2%
Salalah	1999 to 2025	27	0.66	4.30	4.50	7.5%
Colombo	2005 to 2025	21	2.46	8.29	8.29	6.3%
Hambantota	2023 to 2025	3	0.00004	0.43	0.43	<1% (not significant)
Vizhinjam	2025	1	1.30	1.30	1.30	<1% (not significant)

Hubs with predetermined carrier shipments would be first to reap : Tanjung Pelepas reached about 2 million TEU in its second year and Vizhinjam 1.3 million in its first. Salalah took seven years to reach 2 million, and Hambantota's container traffic was near zero until 2024.

Empirical Analysis

Using the four ports with long records of 82-port years, the regressions test whether hub traffic follows the host economy:

$$\ln(TEU_{it}) = \alpha_i + \beta_1 \ln(GDP_{it}) + B_2(WORLD_t) + B_3 \ln(AGE_{it}) + \varepsilon_{it}$$

where TEU is port turnover, GDP is host-country GDP, WORLD is global container throughput, AGE is years since opening, and α is a port fixed effect. Each coefficient is an elasticity.

Table 4. Regression results (dependent variable: log of port throughput unless stated)

Model	Specification	Host GDP	World trade	N	R-squared
M2	Port fixed effects, GDP only	0.65***		82	0.86
M3	Full model with port age	-0.13	0.95	82	0.93
M4	Annual changes	-0.39	1.48**	86	0.07
M5	Reverse test (dependent: GDP growth)	lagged port growth -0.08	1.50***	82	0.42
M7	Verified and cross-checked records only	-0.09	1.25***	38	0.91

Note. *** $p < .01$, ** $p < .05$. Standard deviation error clustered by port in M2 to M5 and heteroskedasticity-robust in M7. With four clusters, clustered errors are approximate (Cameron et al., 2008).

It becomes conspicuous that larger economies maintain busier ports in M2. This link later vanishes once world trade is included in M4. In annual changes (M4), a 1% rise in international trade raises hub traffic by 1.48%. Meanwhile, host GDP has no detectable effect; Colombo alone behaves the same way. The port growth ultimately does not predict later GDP growth (M5), and in Colombo's record year of 2024 the Western Province's share of Sri Lankan GDP actually fell (Central Bank of Sri Lanka 2025). These results uphold on checked records alone (M7). Great Nicobar's traffic will therefore depend on carriers' hub decisions, not India's growth.

6. Scenarios and Cost-Benefit Results

Three demand scenarios can be characterized by specific comparator ramp-levels: low (Hambantota, no carrier, 2.5M TEU plateau), medium (Salalah and Piraeus, semi-fold commitment) and high (Tanjung Pelepas, anchor carrying capacity 16.0M). These specific operants are assumed to start in 2031, and phases are added at 80% utilisation. The model runs from 2027 to 2074 using a base currency of 2026 rupees. Following Boardman et al. (2018), economic NPV measured value to India at 8% . The financial NPV would come in the form of the port enterprise's cash, discounted at 10%. The key inputs can be attributed to the revenue of Rs 6,500 per TEU (based on Salalah; TradeArabia, 2026), a 25% cost overrun (Flyvbjerg et al., 2002), shipper savings of US\$20 per Indian TEU, spillovers of 10% of value added, and priced forest and carbon input losses (de Groot et al., 2012; U.S. Environmental Protection Agency, 2023). The 20,000 Monte Carlo simulation runs a scenario (low 30%, medium 45%, high 25%) and every input from its range.

Table 5. Net present value by scenario and Monte Carlo results (projections, not observations)

Scenario	Economic NPV to India (8%)	Financial NPV of port (10%)	Internal rate of return	Probability economic NPV > 0	Strategic value needed per year
Low	-Rs 23,312 crore	-Rs 19,642 crore	-2.4%	0%	about Rs 1,780 crore
Medium	-Rs 17,757 crore	-Rs 18,294 crore	2.7%	1.0%	about Rs 1,360 crore
High	-Rs 9,689 crore	-Rs 15,193 crore	5.4%	20.8%	about Rs 740 crore
All 20,000 runs (mean)	-Rs 18,825 crore	-Rs 18,842 crore		5.5%	

Note. Strategic value needed is the annual benefit required to close the economic NPV gap. Indigenous land, the leatherback beach, coral reef and tsunami risk are not priced and would raise these thresholds.

Every scenario is negative. Environmental costs (Rs 6,566 crore in present value) are real but not decisive: without them, every scenario would still be negative. Table 6 moves each input to the ends of its range with others held at the medium scenario.

Table 6. Sensitivity of economic NPV (medium scenario, base -Rs 17,757 crore)

Input	Unfavourable value	NPV	Favourable value	NPV	Swing
Revenue per TEU	Rs 4,500	-Rs 27,228 cr	Rs 8,500	-Rs 8,289 cr	Rs 18,939 cr
Cost overrun	+60%	-Rs 26,884 cr	0%	-Rs 11,238 cr	Rs 15,646 cr
Traffic plateau	3M TEU	-Rs 22,729 cr	12M TEU	-Rs 9,551 cr	Rs 13,178 cr
Savings to shippers	US\$0	-Rs 21,767 cr	US\$40	-Rs 13,747 cr	Rs 8,020 cr
Operating cost per TEU	Rs 3,800	-Rs 21,301 cr	Rs 2,200	-Rs 14,213 cr	Rs 7,088 cr
Discount rate	10%	-Rs 20,041 cr	6%	-Rs 13,175 cr	Rs 6,866 cr
Wider spillovers	0%	-Rs 19,731 cr	30%	-Rs 13,808 cr	Rs 5,923 cr
Carbon price	US\$190	-Rs 20,813 cr	US\$50	-Rs 16,059 cr	Rs 4,754 cr
Construction delay	3 years	-Rs 20,765 cr	none	-Rs 17,757 cr	Rs 3,008 cr

No single input lifts the medium case above zero. Table 7 compares the 1,108 successful Monte Carlo runs with the full sample.

Table 7. Median inputs in all runs and in runs with positive economic NPV

Input	All runs	Successful runs	Rank correlation with NPV
Traffic plateau	6.8M TEU	16.1M TEU	+0.51
Revenue per TEU	Rs 6,515	Rs 7,226	+0.31
Cost overrun	+23%	+6%	-0.61
Savings to shippers	US\$20	US\$26	+0.17
Wider spillovers	15%	20%	+0.14
Construction delay	2 years	1 year	-0.11

Cost overrun and traffic plateau take control. Break-even needs about 16 million TEU at Rs 7,000 per TEU, or 10 million at Rs 8,500, and the high case turns positive only at discount rates of 6% or below.

Table 8. Probability of positive economic NPV under alternative conditions

Condition	Probability NPV > 0	Mean economic NPV
<i>Competition tests (4,000 runs)</i>		
Anchor carrier secured in advance	10.8%	-Rs 15,527 crore
Base values	6.4%	-Rs 18,772 crore
Regional overcapacity (demand 30% lower)	2.2%	-Rs 21,490 crore
No anchor carrier and overcapacity	0.6%	-Rs 23,964 crore
<i>Construction strategy (5,000 paired runs)</i>		
Staged: add phases at 80% utilization	5.8%	-Rs 18,668 crore
All 16M TEU built in the same time period	2.8%	-Rs 35,043 crore

Note. Each group uses its own set of simulations; compare rows within a group.

Staging is worth about Rs 16,400 crore, the option value described by Dixit and Pindyck (1994), and an anchor carrier roughly doubles the odds of success. Overcapacity is a real risk as Colombo, Hambantota and Vizhinjam all expand.

Discussion and Conclusion

The historical record cannot exactly forecast the Great Nicobar's returns, but it reliably identifies what decides it. Successful hubs were able to procure demand first and build second; Hambantota did the reverse. Thus, it was leased away to repay its debts and losses. Great Nicobar's plan, in which a state vehicle builds before a specific operational demand and procedure (India Seatrade News, 2026c), resembles Hambantota. Two findings cut against common claims: the port is unlikely to transform the regional economy, and priced environmental costs are not what makes it unviable.

The port's expected economic NPV is about -Rs 18,800 crore, with a 5.5% chance of positive returns. Profits only come with traffic near 16 million TEU, tariffs above Rs 7,000 per TEU, small overruns and an early carrier commitment, built in stages. Otherwise, its case is strategic at a rate Rs. 740 to 1,780 crore a year before any value is placed on Shompen and Nicobarese land.

Limitations: The regressions reside on four ports. Overall, 52 records and all GDP values await verification; revenue per TEU is estimated. In addition, airport, township, strategic value and indigenous rights have not yet found an official price.

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